1. You pull a spring with a force scale and it stretches from 15.0 cm to 19.0 cm with 6.0 N of force.

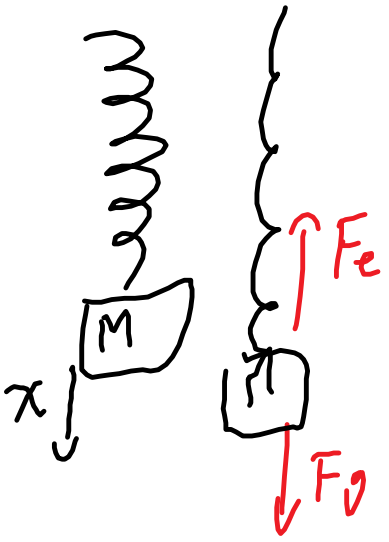
a) What is the extension?

x=change in length = 19.0-15=4.0cm

b) what is the elastic constant, k, for the spring?

$F_e = -kx$ $k = F/x = 6.0N/4.0cm = 1.5$ N/cm or 150 N/m

c) What if you hang a 500 g mass from that spring. What will be the new length of the spring?




$|F_e| = |F_g|$

$+kx = mg$

500g

$x = \frac{mg}{k} = \frac{0.50kg(9.8\ N/kg)}{1.5\ N/cm}$

$x = 3.3cm$ $L = 15 + 3.3$

$= 18.3\ cm$

d) You pull the 500g mass hanging on the spring down 2.0 cm more and let go. What is the acceleration of the mass?

$a = F_{net}/m = (F_e - F_g)/m = (kx - mg)/m$

[1.5N/cm (3.3+2) - (0.5kgx 9.8N/kg)]/0.5kg
a= 1.5x5.3=7.95
7.95-4.9=3.05
3.05/0.5=6.1 $m/s^2$

Topics on Test Tuesday Nov 29th

Newton's Laws

1. Law of Inertia - objects stay in constant speed constant direction motion unless acted upon by unbalanced forces.
2. Law of acceleration $a=F_{net}/m$ where $F_{net}$ is the sum of all forces on the object mass, m.
3. Action-reaction Law - for every force object A acts on object B, object B reacts with an equal and opposite force on A.

eg. if you try to step off a skateboard, the skateboard rolls back.


$F_f = \mu F_N$
friction force is proportional to the Normal force

between the surfaces.
The normal force is the force the surface pushes back with, perpendicular to the surface.
$\mu$ is the coefficient of friction - determined by the nature of the surfaces in contact.

On a flat, non-accelerating surface, the normal force is equal to the weight if there are no other up/down forces.

weight = force of gravity = $F_g = mg = GMm/r^2$

near Earth g=9.8N/kg

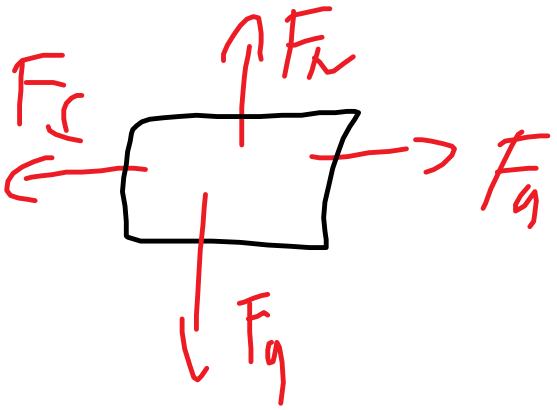
generally

$G=6.67 \times 10^{-11} Nm^2/kg^2$

Quiz

1.

a) forces on the block



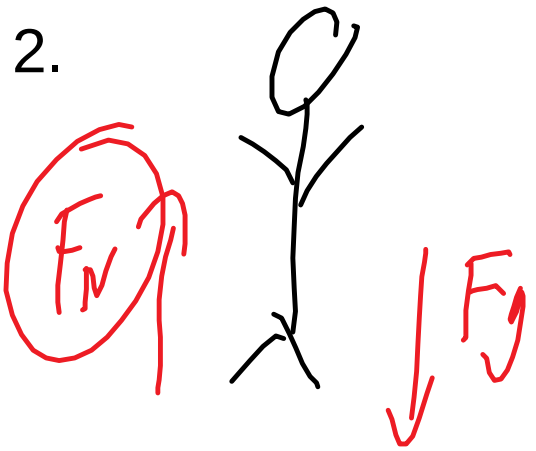
b) Weight = Force of gravity = mg
0.25 kg or 0.45 kg x 9.8N/kg
= 2.5N or 4.4N

No Friction

c) $a = F_{net}/m = (F_a - F_f)/m = (1.5N - 0)/0.25$ or 0.45
$a = 6.0\ m/s^2$ or $3.3\ m/s^2$

d) 2.0 m/s - constant speed
$F_f = F_a$ like in the lab
$\mu = F_f/F_N = F_a/F_g = 1.5N/\ 2.5N$ or 4.4N
= 0.60 or 0.34

2.




$F_{net} = ma = F_N - F_g$

$F_N = ma + F_g$

$F_N = 60kg(2m/s^2) + 60 \times 9.8\ N/kg$

$F_N = 940N$ or $780N$

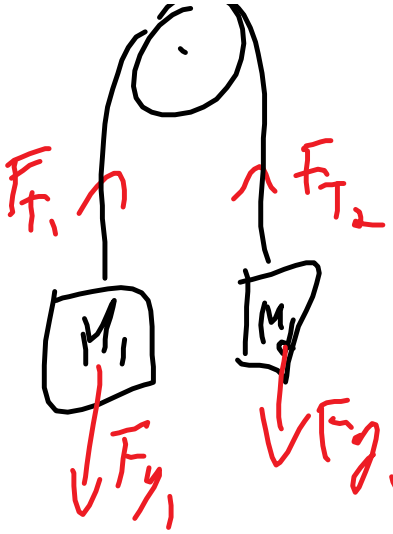
b) v is constant so $a = 0$

so $F_N = F_g = 60 \times 9.8$

$= 590N$

or $790N$

3 a)




or 790 N

$F_{net} = F_{g_2} - F_{g_1} = ma$

$m_2 g - m_1 g = (m_1 + m_2)a$

$m_2 g - m_1 g = m_1 a + m_2 a$

$m_2 g - m_2 a = m_1 a + m_1 g$

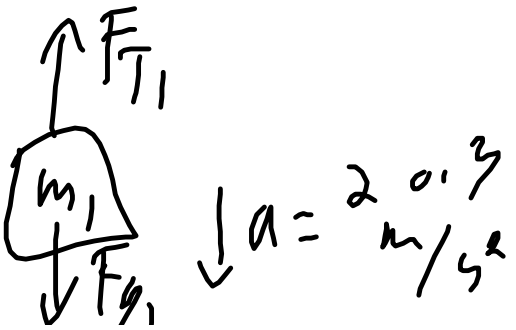
$m_2 g - m_2 a = m_1 (a + g)$

$$m_1 = \frac{m_2 g - m_2 a}{a + g}$$

$$m_1 = \frac{4(9.8) - 4\left(\frac{2}{3} \text{ or } \frac{2}{3}\right)}{\frac{2}{3} \text{ or } \frac{2}{3} + 9.8}$$

$m_1 = 2.1 \text{ kg}$ or $2.6 \text{ kg}$

b)

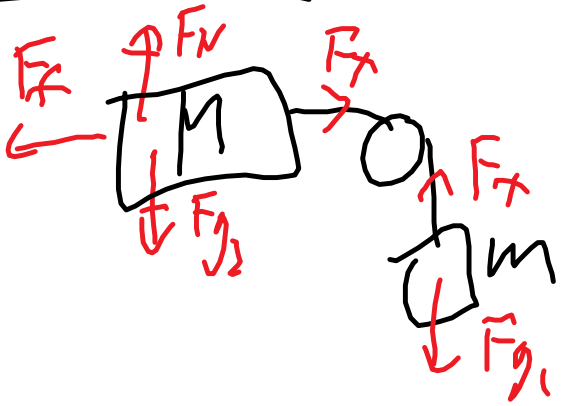


$$F_{net} = ma = F_{g_1} - F_{T_1}$$

$$4\,kg\left(\begin{matrix}3\text{ or}\\2\end{matrix}\ m/s^2\right) = 4 \times 9.8 - F_{T_1}$$

$$F_{T_1} = \underline{27\,N \text{ or } 31\,N}$$

## Bonus




$$F_{net} = F_{g_1} - F_f$$

$$a = \frac{m_1 g - \mu m_2 g}{m_1 + m_2}$$

$$a = \frac{2\,kg - \frac{0.1}{0.2}(6\,kg)(9.8)}{2\,kg + 6\,kg}$$

$$a = 1.7\,m/s^2 \text{ or } 0.97\,m/s^2$$